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ECE 637
Exam #2

3 $x(n) = f(nT)$

3.1) $$\left.\frac{df}{dt}\right|_{t=n-\frac{1}{2}} = \frac{x(n)-x(n-1)}{n-(n-1)} = x(n) - x(n-1) = x(n) * h(n)$$

$$\hookrightarrow \boxed{h(n) = \delta(n) - \delta(n-1)}$$

3.2) $$\left.\frac{df}{dt}\right|_{t=n+\frac{1}{2}} = \frac{x(n+1)-x(n)}{n+1-n}$$

$$\left.\frac{d^2f}{dt^2}\right|_{t=n} = \frac{x(n+1)-x(n)-(x(n)-x(n-1))}{(n+1-n)-(n-(n-1))}$$

$$= x(n+1) - 2x(n) + x(n-1) = g(n) * x(n)$$

$$\hookrightarrow \boxed{g(n) = \delta(n+1) - 2\delta(n) + \delta(n-1)}$$

3.3) First, check to see if the first derivative is larger than some threshold T and that the second derivative changes sign

Let $d_1(n) = x(n+1) - x(n)$
$d_2(n) = x(n+1) - 2x(n) + x(n-1)$

$B = \{|d_1(n)| \geq T\}$ and $\{d_2(n)d_2(n-1) \leq 0\}$ or $\{d_2(n+1)d_2(n) \leq 0\}$

where boolean $B=1$ indicates an edge